

STS-134 Re-Rendezvous Design History

Timothy D. Stuit¹

United Space Alliance, Houston, TX, 77058

In preparation to provide the capability for the Orion spacecraft to rendezvous with the International Space Station (ISS), a new suite of relative navigation sensors are in development and will be tested on one of the final Space Shuttle missions to ISS. The National Aeronautics and Space Administration (NASA) commissioned a flight test of prototypes of the instruments on STS-134, in order to test their performance in the space environment during the nominal rendezvous and docking, as well as a re-rendezvous dedicated to testing the prototype sensors following the undocking of the Space Shuttle Orbiter at the end of the mission. Unlike the initial rendezvous and docking, the re-rendezvous profile would replicate the newly designed Orion coelliptic approach trajectory, something never before attempted with the Shuttle Orbiter. Therefore, there were a number of new parameters that needed to be conceived of, designed, and tested for this re-rendezvous to make the flight test successful. And all of this work had to be integrated with the normal operations of the ISS and Shuttle and had to conform to the constraints of the mission and vehicles. The result of this work is a separation and re-rendezvous trajectory design that will prove not only the design of the relative navigation sensors for the Orion vehicle, but also will serve as a proof of concept for the Orion rendezvous trajectory itself. This document presents the analysis and decision making process involved in attaining the final STS-134 re-rendezvous design.

¹ Rendezvous Design Engineer, Orbit Flight Design and Dynamics, 1150 Gemini, Houston, TX 77058/USH483L, and AIAA Senior Member - Lifetime.